1,148,977

PATENT SPECIFICATION

DRAWINGS ATTACHED

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Date of Application and filing Complete Specification: 26 April, 1967.

No. 19318/67.

Application made in France (No. 62402) on 20 May, 1966.

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Index at acceptance:—H2 C(3B3, 3B5)

Int. Cl.:—H 01 b 17/42

COMPLETE SPECIFICATION

Improvements in Pinned Insulators

We, COMPAGNIE GENERALE D'ELECTRO-CERAMIQUE, a French Body Corporate of 12, rue de la Baume, Paris 8e, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to finned insulators, and is more particularly concerned with high-voltage self-washing insulators, i.e. insulators which are cleaned by the action of rain water trickling over them, such insulators consisting essentially of a solid ~~~

vention, the thickness of the or each fin decreases in the outer radial direction.

In a particular embodiment of the invention, if the apices of the two ridges nearest the stem of the insulator is joined by one line in each case and the troughs of the valleys associated with the ridges are joined by a further line in each case, the lines form cones, the half angles of which are less than 12° in respect of the outer cone envelope and less than 7° in respect of the inner cone envelope, a third ridge at the fin periphery being contained within the outer cone envelope.

ERRATUM

SPECIFICATION No. 1,148,977

Page 1, Title *for* "Improvements in Pinned Insulators" *read* "Improvements in Finned Insulators"

THE PATENT OFFICE
10th June 1969

each side of the fin, the dimensions of the fin being such that the ratio of the axial thickness of the fin at the periphery thereof to the fin pitch is less than 0.5, the radial depth of the fin is greater than 20 mm, the axial thickness at the fin periphery lies between 6 and 18 mm, and the length of the fin pitch lies between 15 and 50 mm.

The ratio of the axial thickness of the fin at the periphery thereof and of the fin pitch may lie between 0.3 and 0.45, the depth of the fin between 25 and 50 mm, and axial thickness of the fin at the fin periphery between 8 and 12 mm and the length of the fin pitch between 18 and 35 mm.

The radius of the ridges of the or each fin is preferably less than the radius of the valleys, and in a preferred form of the in-

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fin radial depth *a*

fin axial thickness at fine periphery *e*.

Figure 1 shows a fin of known type having two ridges of the same axial thickness, the half-view on the left shows a solid stem, whereas the right hand half-view shows a hollow stem.

In the form shown in Figure 2, the fin has three ridges which are very considerably rounded and comprise a ridge 1 at the fin periphery and two ridges 2 and 3 intermediate the ridge 1 and the stem 4. The thickness of the fin decreases in the outer radial direction. The ratio e/p is selected to be lower than 0.5, and is preferably between 4.3 and 0.5, the depth *a* is greater than 20 mm, preferably between 25 and 50 mm, the thickness *e* between 6 and 18 mm, preferably between 8

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The present invention relates to finned insulators, and is more particularly concerned with high-voltage self-washing insulators, i.e. insulators which are cleaned by the action of rain water trickling over them, such insulators consisting essentially of a solid or hollow stem on which one or more helical fins are formed.

The invention is concerned with the improvement of the properties of such insulators, especially their flashover voltage in a polluted atmosphere.

According to the present invention, there is provided an insulator comprising a stem which is a body of revolution and one or more helical fins integral with the stem, wherein the or each fin is of corrugated shape, when the insulator is considered in longitudinal section, with at least three ridges on each side of the fin, the dimensions of the fin being such that the ratio of the axial thickness of the fin at the periphery thereof to the fin pitch is less than 0.5, the radial depth of the fin is greater than 20 mm, the axial thickness at the fin periphery lies between 6 and 18 mm, and the length of the fin pitch lies between 15 and 50 mm.

The ratio of the axial thickness of the fin at the periphery thereof and of the fin pitch may lie between 0.3 and 0.45, the depth of the fin between 25 and 50 mm, and axial thickness of the fin at the fin periphery between 8 and 12 mm and the length of the fin pitch between 18 and 35 mm.

The radius of the ridges of the or each fin is preferably less than the radius of the valleys, and in a preferred form of the invention, the thickness of the or each fin decreases in the outer radial direction.

In a particular embodiment of the invention, if the apices of the two ridges nearest the stem of the insulator is joined by one line in each case and the troughs of the valleys associated with the ridges are joined by a further line in each case, the lines form cones, the half angles of which are less than 12° in respect of the outer cone envelope and less than 7° in respect of the inner cone envelope, a third ridge at the fin periphery being contained within the outer cone envelope.

Two embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which,

Figure 1 shows, diagrammatically, a fin profile of known type,

Figure 2 shows, diagrammatically, a fin profile of an insulator according to the invention, and

Figure 3 shows a further embodiment of the invention.

The figures show a section through one turn of a helical fin having:

pitch p

fin radial depth a

fin axial thickness at fine periphery e.

Figure 1 shows a fin of known type having two ridges of the same axial thickness, the half-view on the left shows a solid stem, whereas the right hand half-view shows a hollow stem.

In the form shown in Figure 2, the fin has three ridges which are very considerably rounded and comprise a ridge 1 at the fin periphery and two ridges 2 and 3 intermediate the ridge 1 and the stem 4. The thickness of the fin decreases in the outer radial direction. The ratio e/p is selected to be lower than 0.5, and is preferably between 4.3 and 0.5, the depth a is greater than 20 mm, preferably between 25 and 50 mm, the thickness e between 6 and 18 mm, preferably between 8

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and 12 mm. The pitch p varies from 15 to 50 mm; preferably from 18 to 35 mm and the radius r of the ridges is approximately $\frac{3}{4}$ of the radius R of the valleys. In the case of a fin having a radial depth of 40 mm, the radius of the ridges will be approximately 3 mm and the radius of the valleys will be, proceeding from the stem towards the edge, 5—4—3.5 mm. In the case of varying radial depths of fin, these dimensions will be modified approximately in the same ratio as that of the measurement of the fin height. Since the height of the ridges decreases in proportion in the outer radial direction, if the apex of the two ridges 2 and 3 nearest to the stem 4 of the insulator and the valleys 5, 6, 7 formed between the said ridges are joined by two lines, it will be found that these lines form a cone the half-angles b of which are less than 12° in respect of the outer cone envelope 8 and the half-angles c of which are less than 7° in respect of the inner cone envelope 9. Furthermore, the ridge 1 is contained within the outer cone envelope 8, for example b will be equal to 10.6°, and c to 6.7°.

In the embodiment illustrated in Figure 3, the fin comprises ridges in the form of spaced "teeth" leaving a considerable recess between them, the radius of the central ridge and that of the ridge adjacent the stem being approximately $\frac{1}{4}$ of the radius of the central valley, the end ridge 1 having a radius double that of the further ridges 2 and 3.

In the case of a fin having a radial depth of 32.5 mm, the radius of the central ridge 2 and the ridge adjacent the stem 3 will be approximately 1 mm. The radius of the end ridge 1 will be approximately 2mm. The radius of the valleys will be, proceeding from the stem towards the periphery, 5.5—4.5—4.5 mm. With different fin depths, these dimensions will be modified approximately in the same ratio as that of the measurement of the said depths.

The enveloping curves of the apices of the ridges and of the troughs of the valleys constitute cones having half angles b less than 12° in respect of the external cone envelope, and half-angles c less than 7° in respect of the inner cone envelope, for example b will be equal to 7° and c to 4.5°.

The table shown hereinbelow gives, by way of example, some numerical values for certain dimensions and certain dimensional ratios relating to some embodiments of known fins and fins according to the invention. The fins 1 and 2 are of the type shown in Figure 1, the fins 3 have a profile corresponding to that of Figure 2, and the fins 4 and 5 a profile corresponding to that of Figure 3.

TABLE 1

	1	2	3	4	5
Helix Pitch: p in mm.	40	26	26	22	19.3
Fin depth: a in mm.	35	26.5	38.5	32.5	28
End thickness of the fin: e in mm.	15	10	10	8	8
leakage path per fin: If in mm.	122	82	114	90	81.5
Ratio a/p	0.875	1.02	1.48	1.48	1.45
Ratio e/p	0.375	0.385	0.385	0.364	0.415
Ratio If/p	3.05	3.15	4.38	4.09	4.22

There are given hereinbelow some comparative results of tests effected on insulators provided with fins of known type and with fins according to the invention, as defined in the preceding table. If, for example, an element is formed from a support column, with the stem or shank diameter 110 mm, the total height of the element 756 mm, and having a fine according to 1, and an element having the same general dimensions, having a fine according to 4, and if these two elements are subjected to a pollution test under the following conditions:

constantly applied voltage: 52 kV
pollution cycle: 3 hours deposit of dust at the rate 750 g per hour, using a kaolin dust, followed by 3 hours of saline mist (solution of 31 g of NaCl per litre of water), at the rate of 16 litres per hour.

It is found that, with a series of four tests, the insulator equipped with conventional fins according to type 1 held 2—2—3—2 cycles, whereas the insulator equipped with fins according to 4 held 3—3—4—4 cycles before flashover.

If insulators are manufactured of the type known under the name of "Spirelec", this being a trade mark registered by the applicants, with a fine corresponding to the profile type 3 having spaced teeth in accordance with the invention, and if the insulators are comparatively subjected to dust-depositing cycles identical with those described hereinabove, it is found that the insulator of conventional type holds 3 cycles, whereas the insulator provided with fins according to the invention holds 4 cycles.

If, for these same insulators, the value of the leakage current is measured in μ A (measured under convention rain—3 mm/minute, 10,000 Ohm cm) for different voltages in kV, the results shown in table 2 are obtained, and these show clearly the advantage achieved by designing the fin in accordance with the invention.

TABLE 2

	Leakage current							
Voltage applied	20	40	60	80	100	120	140	160
Insulator having a conventional fin, type 2	780	1680	3400	5000	6700	8600	10800	12600
Insulator having a fin according to the invention type 5	360	910	1500	2010	2700	3700	4500	5600

If, on the other hand, a comparison is effected between two insulators of the "Spirelec" type of a model differing from that of the preceding insulators, one thereof being provided with a fin according to the known profile, type 1, whereas the other is provided with a fin of the profile type 5 according to the invention, and if they are subjected to a disruptive voltage test under pollution;

the voltage applied is 63 kV for a chain of two insulators, the dust-depositing cycle is 3 hours of kaolin dust, followed by 3 hours saline mist,
each cycle being separated by washing for 5 minutes with rain of conventional intensity (3mm/minute) and with a resistivity of 7000 Ohm cm, it is found that the insulator having a conventional fin withstands 21 cycles before flashover, the insulator having a fin according to the invention withstands 38 cycles, i.e. an improvement of 81%.

These examples show the advantages achieved in insulators by adopting a profile according to the invention as defined hereinabove with regard particularly to the resistance to disruption in a polluted atmosphere. It is known that it is at the present day held that these functioning conditions are among the most significant when appreciating the value in use of an insulator.

It will be clearly understood that the fin profile according to the invention may be applied equally well to an apparatus insulator and to a line insulator, to a support column or to an envelope, and equally well to a suspension insulator of the type having a long stem for example, whatever the material used or the details in respect of design, manufacture and assembly of the insulating part.

WHAT WE CLAIM IS:—

1. An insulator comprising a stem which is a body of revolution and one or more helical fins integral with the stem, wherein the or each fin is of corrugated shape, when the insulator is considered in longitudinal section with at least three ridges on each side of the fin, the dimensions of the fin being such that the ratio of the axial thickness of the fin at the periphery thereof to the fin pitch is less than 0.5, the radial depth of the fin is greater than 20 mm, the axial thickness at the fin periphery lies between 6 and 18 mm, and the length of the fin pitch lies between 15 and 50 mm.

2. An insulator according to claim 1, wherein the ratio of the said axial thickness to the fin pitch lies between 0.3 and 0.45.

3. An insulator according to claim 1 or 2, wherein the radial depth of the fin lies between 25 and 50 mm.

4. An insulator according to any one of claims 1 to 3, wherein the said axial thickness lies between 8 and 12 mm.

5. An insulator according to any one of claims 1 to 4, wherein the length of the fin pitch lies between 18 and 35 mm.

6. An insulator according to any one of claims 1 to 5, wherein the or each fin has a ridge at the periphery of the fin and two ridges intermediate the fin periphery and the stem.

7. An insulator according to claim 6, wherein the radius of the ridges of the or each fin is approximately $\frac{3}{4}$ of the radius of the valley, centrally of the two intermediate ridges.

8. An insulator according to claim 6, wherein the radius of the ridges of the or each fin is approximately $\frac{1}{4}$ of the radius of the valley centrally of the two intermediate ridges.

9. An insulator according to claim 6, 7 or 8, wherein the axial thickness of the or each fin decreases in the outer radial direction of the insulator, and the half-angles at the apex of the cone envelope defined by the planes containing the apices of the two intermediate ridges is less than 12°.

10. An insulator according to any one of claims 6 to 9, wherein the axial thickness of the fin decreases in the outer radial direction and the half-angle at the apex of the cone envelope defined by the planes containing the troughs of the valleys is less than 7°.

11. An insulator according to claim 9 or 10, wherein the peripheral ridges are contained within the envelope of the cone defined by the planes containing the apices of the two intermediate ridges.

12. An insulator according to any one of claims 1 to 11, wherein the radius of the ridges of the or each fin is less than the radius of the valleys.

13. An insulator according to any one of claims 6 to 12, wherein the radius of the ridge at the periphery of the or each fin is double that of the further ridges.

14. An insulator substantially as hereinbefore described with reference to Figure 2 or 3 of the accompanying drawings.

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1148977. COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale

FIG.1

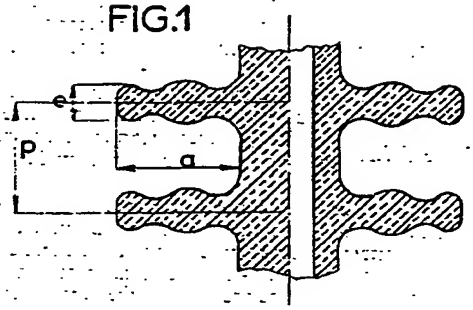

FIG. 2

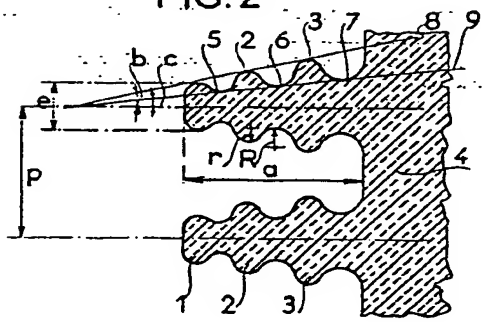

FIG.3